

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION



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TO: De Montgomery, Chief, Geotechnical Support Unit H.W.  
Permits Section  
Waste Management Division

FROM: Tarik Namour, Geotechnical Engineer  
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Waste Management Division

Subject: Evaluation of Cap Design Alternative  
J & L Superfund Landfill

Per your request, I have examined the performance of geosynthetic clay liners (GCL) which are to be used as part of the cap components at J & L superfund site.

In the past, the U.S. EPA proposed to use GCL as a partial substitute for the three feet of clay liner for the Bofors Nobel superfund landfill, Muskegon, Michigan. The U.S EPA proposed three cap design alternatives. The first alternative makes use of GCL as full replacement for the three feet of the clay layer. The second and third alternatives consist of a composite system made up of a GCL with one and two feet of clay, respectively. The three cap design alternatives include 6-inches of top soil, 18-inches of root zone (protective layer), a lateral drainage layer and a flexible membrane liner (FML). We evaluated the performance of the GCL by utilizing the HELP model for the three alternatives. The protective layer thickness used in the model range from 18 to 36-inches, and the recompacted clay layer thickness beneath the GCL range from 12 to 24-inches (see attachment 1). The performance of GCL was evaluated based on the ability of the GCL to restrict infiltration of water into the waste. The following will summarize the results obtained from the HELP model:

**Alternative #1**

- 6-inches top soil
- 18-inches protective layer
- 0.3-inch nonwoven needle-punched geotextile heat bounded to
- both sides of geonet
- 0.3-inch layer consists of 40 mil VLDPE and GCL

Average annual percolation from the 40 mil & GCL= 1786CU.FT

Alternative #2

- ° 6-inches top soil
- ° 36-inches protective layer
- ° 0.3-inch nonwoven needle-punched goetextile heat bounded to both sides of geonet
- ° 0.3-inch layer consists of 40 mil VLDPE and GCL
- ° 12-inches recompacted clay liner

\*Average annual percolation from the 40 mil & GCL and clay

= 1455 CU.FT

Alternative #2.1 : Same as alternative 2. However, it is modeled differently.

- ° 6-inches top soil
- ° 36-inches protective layer
- ° 0.3-inch nonwoven needle-punched goetextile heat bounded to both sides of geonet
- ° 12.3-inch layer consisting of 40 mil VLDPE, GCL and 12-inch recompacted clay

Average annual percolation from the 40 mil & GCL = 1178CU.FT

Alternative #3: The thickness of the protective layer of alternative 2.1 is reduced from 36 to 24 inches

- ° 6-inches top soil
- ° 24-inches protective layer
- ° 0.3-inch nonwoven needle-punched goetextile heat bounded to both sides of geonet
- ° 12.3-inch layer consisting of 40 mil VLDPE, GCL and 12-inch recompacted clay

Average annual percolation from the 40 mil & GCL= 1202CU.FT

Alternative #4: The thickness of the clay layer of alternative 2.1 is increased from 12 to 24 inches

- ° 6-inches top soil
- ° 36-inches protective layer
- ° 0.3-inch nonwoven needle-punched goetextile heat bounded to both sides of geonet
- ° 24.3-inch layer consisting of 40 mil VLDPE, GCL and ~~12~~<sup>24</sup>-inch

recompacted clay

Average annual percolation from the 40 mil & GCL = 969CU.FT

Alternative #5: The thickness of the protective layer of alternative 3 is reduced from 36 to 24 inches

- ° 6-inches top soil
- ° 24-inches protective layer
- ° 0.3-inch nonwoven needle-punched geotextile heat bounded to both sides of geonet
- ° 24.3-inch layer consisting of 40 mil VLDPE, GCL and 12-inch recompacted clay

Average annual percolation from the 40 mil & GCL = 981CU.FT

Based on the HELP model results, alternatives 2.1, 3, 4 and 5 provide similar performance (the rationale used to model alternative 2.1 is more realistic than the rationale used to model alternative 2). However, alternatives 2 and 4 provide better frost penetration protection to the clay liner. To account for frost protection requirement, It is recommended that alternatives 2 or 4 be selected for the final cover design. Please refer to our letter to Mr. Terry Hartman, attachment # 2 for more details on the use of GCL as part of the final cover components and our preferable alternative.

Alternative #1 was not selected due to the lack and need of compatibility test for the bentonite in contact with waste materials and the lack of information regarding its stability. In my opinion the bentonite layer will act as a glue to seal holes in the clay layer and the FML. Better final cover performance is obtained when the GCL is combined with clay liner. The use of material with high permeability beneath the bentonite will weaken the performance of the GCL due to the bentonite being washed out. To avoid the wash out of bentonite particles, clay should be used instead of sand and or waste material.

In summary, based on the results obtained from the HELP model and our experience with final cover designs, the use of GCL in conjunction with clay shall perform adequately and compares well with J & L alternative 3b. However, this cap design will not be considered an Act 64 cap because the 1979 PA 64, as amended, the Hazardous Waste Management Act, R 299.9619 (5) does not provide an equivalency option. Based on the frost penetration depth requirement, it is recommended that alternative 2 or 4 be the chosen alternative.

If you have any questions please contact me.